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CHEMICAL & ENGINEERING NEWS

C&EN

MARCH 7, 1994

AFTER SLIMMING DOWN, HERCULES SEES PROFITS AND STOCK PRICES RISE **PAGE 11**

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SCIENCE IN AMERICAN LIFE

ACS-sponsored exhibit set to open at Smithsonian

Page 30

CHEMICAL & ENGINEERING NEWS

C&EN

MARCH 7, 1994

NEWS OF THE WEEK

■ EPA has issued a final rule to cut toxic air emissions from chemical plants almost 90% from 1990 levels. **Page 4**

■ Scientists at Oregon State University have found strong evidence for a biological effect of ozone depletion—a drop in frog and toad populations stemming from UV radiation killing their eggs. **Page 5**

■ Biomass burning is shown to be a significant source of methyl bromide emissions, raising questions about effectiveness of scheduled restrictions on the synthetic compound, a fumigant, in halting ozone depletion. **Page 5**

■ White House urges Congress to ban most exports of hazardous wastes to countries outside North America, implementing an international agreement, the Basel Convention. **Page 6**

■ Plans for commercialization are being prepared for a new nonstick coating discovered by Dow Chemical and licensed to 3M for development and marketing. **Page 6**

■ New industry-government partnership agreement to spur advances in critical semiconductor technologies has been unveiled by the Clinton Administration. **Page 7**

COVER: Smithsonian's logo for "Science in American Life" exhibit

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BUSINESS

Hercules' Thomas Gossage has reinvigorated the old-line specialty chemicals maker, largely by selling nonperforming businesses, cutting capital expenditures, and improving operating profits. **Page 11**

DuPont is reorganizing its R&D program, says new senior vice president for R&D Joseph Miller, with changes in management structure, leadership teams, and marketing. **Page 13**

Business Insights: Clinton Administration's recently released economic forecast sees an upturn in key sectors of particular importance to the chemical industry. **Page 14**

GOVERNMENT

White House has finally moved to support reform of OSHA; proposed legislation seeks changes in areas such as standards-setting, enforcement, and employer-employee relationships. **Page 18**

NSF's latest "Science and Engineering Indicators," a compendium of U.S. science capabilities, points up growing international interaction in research, changes in R&D spending. **Page 20**

SCIENCE/TECHNOLOGY

Feasibility of deliberately engineering Earth's climate—and the social, economic, political, and ethical issues raised by such actions—are examined by researchers and other experts. **Page 26**

Mechanism for the formation of fullerenes from large planar carbon rings, involving a spiraling carbon-chain intermediate, is proposed by a research group at Northwestern University. **Page 27**

PERKIN MEDAL

American Cyanamid's Marinus Los receives the 1994 Perkin Medal for his achievements in applied chemistry, especially his invention of environmentally friendly imidazolinone herbicides. **Page 29**

SPECIAL REPORT

"Science in American Life," a permanent exhibit sponsored by ACS at the Smithsonian's National Museum of American History, scheduled to open in April, allows visitors to explore the dynamic, often controversial, connections between science and society. Page 30

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LETTERS

Response to Luberoff

My friend Ben Luberoff (C&EN, Jan. 31, page 4) said, in essence, that universities are educating chemists to be watchers and that he would like them to be trained to be doers.

That's a common sort of view, Ben, and a dangerous one if we want America to be strong and our industry to prosper. When faced with a practical problem, many of us like to say, "Let's just do it, not take time to study it." That popular choice is a good one if the technologies to be used and the situations to which they are to be applied are thoroughly understood, in all their aspects. But if they are not, a fiasco may result. A little fiasco may do no more than ruin a career, but a big one may cost billions of dollars.

To a considerable extent, Ben, you are asking that the universities train, rather than educate, chemists. I have written before about the importance of education [*J. Chem. Educ.*, **65**, 744 (1988)], and urge you to read what I wrote. I do not deny the importance of good training for technicians, but urge that it not be confused with the mind-broadening experience of true education.

Your letter is also disturbing in that it tends to challenge the validity of fundamental research, that is, research directed toward the recognition of new principles. If we define research as search for knowledge, it spans activities ranging from looking up a physical constant in a handbook (admittedly a marginal case) through finding facts by diligent study in libraries or manuscript archives, and determination of new data by application of known principles, to efforts to discover principles previously unrecognized. You and I would agree that the last of these modes of research would seldom be the one to use for the quick solution of a practical problem. I am, however, alarmed that even the less adventuresome kinds of research that I mentioned are sometimes ignored by "practical" technologists.

It is said, in regard to financial investments, that high returns are associated with high risks. Much the same is true about research. Applied research gives a secure but modest return; it is a kind of insurance against disaster. Fundamental research directed at discovery of new principles is risky, and sometimes totally unfruitful, but when an important new principle is found, a great new industry may result. We need research of all kinds.

It is possible, Ben, that you were dismayed that some recent chemistry Ph.D. recipient was inept doing laboratory work that needed to be done. That can happen if the student's research adviser kept the student busy at a single sort of experimental activity, such as sitting at the console of an instrument, throughout the student's dissertation research. In such a case, the student has been denied the mind-broadening experience of dealing with a variety of methodologies, and might, in extreme cases, almost be said to have been trained as a technician.

Joseph F. Bunnett
University of California
Santa Cruz

Cooperation not confrontation

You are absolutely right (Editor's page, C&EN, Feb. 14, page 3). Resolving the chlorine debate—or any other public policy issue—requires the full cooperation of industry, government, and the public.

That's why we were cheered when then-President-elect Clinton promised a new era in regulatory policy-making, one that stressed cooperation—not confrontation—between industry and government.

We also agree that public policy should not be held hostage to any group's politics or ideology. Policy-making, should be open, inclusive, and grounded in the best scientific information available.

Yes, we do get frustrated when the process breaks down, but the Chemical Manufacturers Association is always ready and eager to work with the Environmental Protection Agency—or any other party—to create policies that, as you so elegantly wrote, "inspire public confidence."

Frederick L. Webber
President, Chemical Manufacturers Association
Washington, D.C.

Letters to the Editor

C&EN encourages readers to contribute to this letters section. However, please keep letters reasonably short—400 words or fewer. Because we receive a heavy volume of letters, persons writing letters are limited, as a general rule, to one letter within any given six-month period.

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standards on ergonomics, medical surveillance, exposure monitoring, and other specific issues.

The outlook for OSHA reform legislation this year is not good. The issue is an emotional one and highly partisan. It is not lost on legislators that the Clinton Administration waited more than a year before coming out in support of workplace safety changes, even though there had been several earlier opportunities. The obvious conclusion is that the Administration would like to see some reform in this area, particularly to please its friends in the organized labor community who were angered by Administration support of the North American Free Trade Agreement. Clinton, however, has not given OSHA top priority.

Any prospects of passing OSHA reform soon are dimmed by the pending retirements of those House leaders seeking health and safety changes. Both Education & Labor Committee chairman Ford and Labor Standards, Occupational Health & Safety Subcommittee chairman Rep. Austin J. Murphy (D.-Pa.) have announced they will leave Congress at the end of this session. Ford was the primary sponsor of OSHA legislation in the House for the past two sessions. At this time, there does not seem to be any member of Congress poised to take up the fight.

David Hanson

NSF report tallies current U.S. science capabilities

Want to know how well American kids rate compared with other schoolchildren around the world in science and math skills? Or what the public thinks of the impact of science and technology on their lives? Or how well the U.S. is competing with other leading countries in the so-called critical technologies? Or the impact of the end of the Cold War on the funding of research in industry and academia?

If so, there's a one-stop way of finding out—by picking up a copy of the 3½ lb, browser-friendly "Science and Engineering Indicators" for 1993. Every two years, the National Science Foundation's (NSF) board of directors, the National Science Board (NSB), issues this hefty compendium of facts about science and technology. The U.S. was the first country to issue such a volume (beginning in 1972 as merely "Science Indicators") and NSF's science resources studies division, which does all the compiling, has pretty much set the world standard for such efforts.

"Indicators," always a science and technology policy event, is customarily accompanied by a policy statement from the board itself. But the board usually uses language that critics find rather homogenized for a body that by charter is expected to set a leading, and critical, tone for national science policy. This time, however, the board summoned uncharacteristic verve in its policy recommendations. Its 23 members are clearly concerned that academic-business collaborations have opened the door to conflict of interest and intellectual property issues. The board calls for development of ethical guidelines governing those relationships. It also calls for a "fresh and vigorous national vision for public support of science and technology." But it disappoints in failing to suggest a way to conjure that vision, or who is to venture the effort.

The 1993 edition, sporting a psychedelic cover of four vitamin crystal photomicrographs, is the biggest yet, at 518 pages. Its chapters cover elementary and secondary science and mathematics education; higher education in science and engineering; the science and engineering work force; financial and institutional linkages in research and development; financial resources, personnel, and outputs of academic R&D; technology development and competitiveness; and public attitudes and understanding of science and technology.

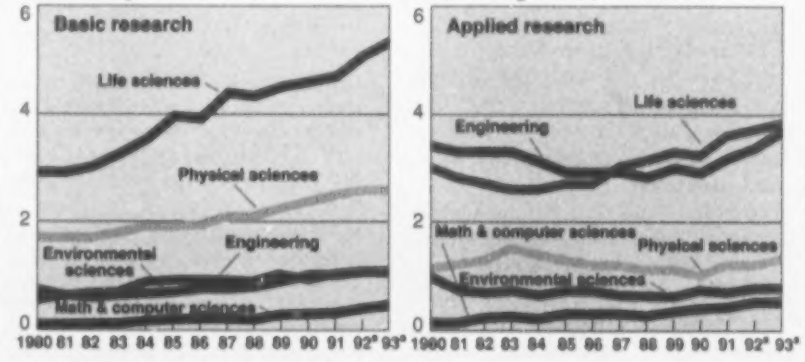
Program director Jennifer Sue Bond wrote the opening overview chapter. She finds that scientific and technical "enterprise" is increasingly global in nature, and that international interaction is increasing. For example, overseas research financed by U.S. companies has grown five times faster than that performed domestically. Foreign firms, for their part, are increasing the amount of R&D they do in the U.S. "Indicators" says foreign R&D made up more than 10% of industry's total in the U.S., U.K., Canada, and France.

Another overall conclusion is that the U.S. continues to undergo changes in the composition of its R&D spending. The federal government supported only 42% of all R&D in 1993, down from 46% in the mid-1980s. Industry spends 52%, with states, universities, and nonprofit organizations making up the rest. Funding from this group has doubled from 3% to 6% since 1985, reflecting a trend toward diversifying sources of support.

The fabled individual investigator effort—fount of technical creativity in the U.S.—has not suffered as much as its advocates say it has. Individual investigators receive more than half of all academic research support, about the same as they always have. The rest, of course, goes to support team, interdisciplinary, and research center efforts.

"Indicators" says the universities are taking on more of the country's R&D—$20.6 billion in 1993—but the federal share has declined. It was 56% in 1993, compared with 68% in 1980. The insti-

Life sciences outpaces other sciences in research funding



Note: Fiscal years. **a** Constant 1987. **Source:** National Science Foundation

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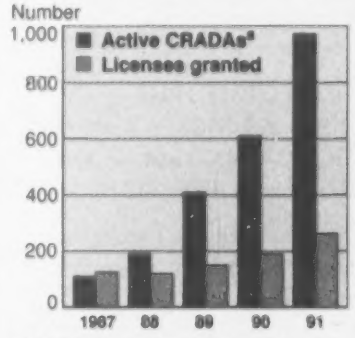
tutions themselves provided 20% last year and industry provided 7.3%. Strangely, the overview almost bends over backward to avoid even the suggestion of a plea for more support, or, at the opposite end, the possibility that academia may have overbuilt its research plant.

In the nearest thing to a statement reflecting the board's political agenda, "Indicators" says the importance of basic research to meeting strategic goals is "receiving increased national attention." Evidence for that is rather slim in "Indicators," since the definition of basic research has gotten looser and looser since the days when Ronald Reagan was President. In any case, the political trend today is toward immersing basic research within a strategic context, much as the NSF's old Research Applied to National Needs program tried to do up until 1980 when NSB, in a stroke that erased a vision, killed it.

However, the 1993 "Indicators" is not shy about using the term "investment"—the Clinton Administration euphemism for "spending," or "support." And it indicates that national goals are going to be the determining element in any further R&D growth. Interagency research initiatives in such areas as biotechnology, global-change research, and advanced materials and processing accounted, at $12.5 billion, for one sixth of 1994 federal R&D support. "And new federal strategic initiatives are being developed," Bond says.

One of those strategic areas—health—is the most robust R&D "investment" in the country, after defense, account-

Federal lab-industry R&D pacts near 1,000 in 1991



a Cooperative research and development agreements; include agreements entered into by National Aeronautics & Space Administration.
Source: Department of Commerce

Funds for dual-use technologies approaching $500 million

Program	Fiscal 1994 R&D funding for defense conversion ($ millions)
Manufacturing experts in the classroom	$ 5
Manufacturing engineering education	44
Defense advanced manufacturing technology partnerships	24
Defense dual-use critical technology partnerships	82
Commercial-military integration partnerships	42
Regional technology alliances assistance	91
Defense dual-use assistance extension	91
Manufacturing extension	82
TOTAL	$461

Source: Advanced Research Projects Agency

ing for 40% of federal basic research spending. However, most of the increases the health area has received have been going to AIDS research.

Overall, the downsizing of the Pentagon's budget has had the most drastic effect on national R&D. The figures, on the surface, paint a confusing picture of the implications of that downsizing for R&D because although R&D accounted for 10% of the defense budget in 1980, it rose to 14% in 1993, according to the report. At the same time, "preliminary data show that the number of R&D scientists engaged in defense-related work declined 6%, dropping from 730,000 in 1990 to 684,000 in 1992. In the aircraft and missiles industry, the decline has been 20%." "Indicators" says the situation will get worse through the nineties.

The Pentagon is trying to soften the impact of such cutbacks by supporting a program of "dual-use" technologies through its Technology Reinvestment Project. TRP, operated out of the Advanced Research Projects Agency, spent $461 million in fiscal 1994 to help high-tech companies switch to technologies that serve both the commercial and defense markets.

In the commercial field, cooperation and collaboration between universities and industry, and within industry, have been spreading wildly. About 1,000 university-industry research projects existed by 1991, 72% with federal funds. Academic and industrial researchers are jointly publishing more than ever. In 1991, 35% of all industrial papers were done in collaboration with academics, compared with 22% a decade earlier.

The section on international competitiveness in technology is perpetually interesting in a shifting landscape. The challenge for "Indicators" is always to remain current with—and even anticipate—shifts and to reckon whether data collected in 1992 appropriately serve the 1994 reader. "Indicators" was essentially completed during the last third of 1993, predominantly using 1992 data. In 1992, an election year, the decline in U.S. competitiveness was a strong concern in the country. Today, however, competitiveness news is dominated by stories about how well the U.S. has caught up with Japan in industry after industry, including autos. There is a new optimism in the air. Leadership in the hottest new set of technologies—those composing the electronic information superhighway—seems to belong to the U.S. But for how long?

"Indicators" believes that other nations are catching up with the U.S. in key high technologies such as communications equipment, computer/office equipment, and electrical machinery. Substantial trade surpluses remain in aircraft, pharmaceuticals, and scientific instruments. Looking further ahead, the report predicts that the impact on global economics by newly emerging countries in technology—Malaysia, India, China, and Indonesia—will be profound.

"Indicators" always devotes a chapter to public attitudes toward science and technology. Accounts of the public attitudes survey roll on, page after page, revealing that "70% of Americans continue to express the view that the benefits of scientific research exceed risks or harms associated with that work." In contrast, "Only 12% thought of themselves being well informed about issues involving new scientific discoveries."

Wil Lepkowski

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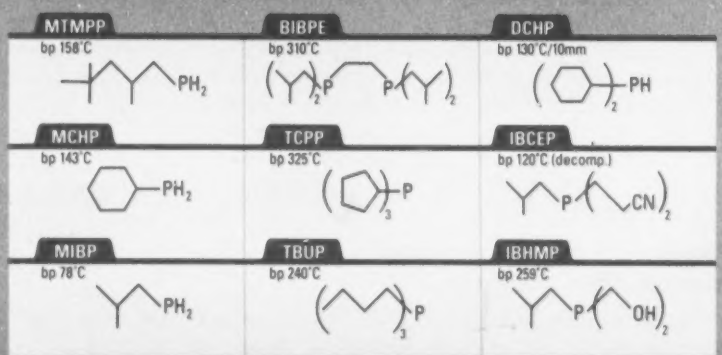

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